Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 11(5): 1761, 5 October 2015 doi: http://dx.doi.org/10.15560/11.5.1761
ISSN 1809-127X © 2015 Check List and Authors

New records of bat flies (Diptera, Streblidae and Nycteribiidae) in Cerrado of Central Brazil

Daniel Figueiredo[1, 2*], **Gustavo Graciolli**[3] and **Ludmilla Moura de Souza Aguiar**[1, 2, 4]

1 Universidade de Brasília (UnB), Departamento de Ecologia, Programa de Pós-Graduação em Ecologia, campus Darcy Ribeiro s/n, Asa Norte, CEP 70970-900, Brasília, DF, Brazil
2 Universidade de Brasília (UnB), Departamento de Zoologia, Laboratório de Biologia e Conservação de Morcegos, Brasília, DF, Brazil
3 Universidade Federal do Mato Grosso do Sul, Centro de Ciências Biológicas e da Saúde, Cidade Universitária, CEP 79070-900, Campo Grande, MS, Brazil
4 Universidade de Brasília (UnB), Departamento de Zoologia, Programa de Pós-Graduação em Zoologia, Brasília, DF, Brazil
* Corresponding author. E-mail: daniel.f.ramalho@gmail.com

Abstract: Here we record the occurrence of 38 species, including 30 species of Streblidae and eight species of Nycteribiidae. Of these, 12 are new records for the Distrito Federal, three are new for the Cerrado, and one, *Trichobius johnsonae* Wenzel, 1966 is the first record from Brazil. We also recorded a yet undescribed species of *Basilia* from the district.

Key words: Brasília, Chiroptera, Distrito Federal, Hippoboscoidea, *Trichobius johnsonae*

Four orders of insects are ectoparasites on bats. Of these, the order Diptera is represented by the most species in New World (Marshall 1982; Whitaker 1998). Two Diptera families, Streblidae and Nycteribiidae are obligatory ectoparasites on bats (Marshall 1982; Guerrero 1993). In Brazil, Streblidae is represented by nearly 70 species (Graciolli et al. 2008) from three subfamilies that exhibit high morphological variability (Whitaker 1988). In contrast, Nycteribiidae is very specialized, presenting a small thorax with dorsal insertions of the legs and head and absence of wings (Peterson and Wenzel 1987). Although more abundant in the Old World, there are 28 species of two genera of Nycteribiidae in Brazil (Graciolli et al. 2007).

Notwithstanding, most studies of bat flies have been conducted in Southern and Southeastern Brazil. Though, the Distrito Federal in central Brazil has the largest number of bat fly species (Graciolli et al. 2010), and the first records date from the 1980s, when Coimbra Jr. et al. (1984) listed 12 streblid species. Currently, there are 44 species reported in the Distrito Federal, five belonging to Nycteribiidae (genus *Basilia*), and 39 species, 14 genera, and three subfamilies belonging to Streblidae (Graciolli and Coelho 2001; Graciolli and Aguiar 2002; Aguiar et al. 2006; Graciolli et al. 2007; Graciolli et al. 2008; Aguiar and Antonini 2011). Herein, we report new records of bat flies in the Cerrado of central Brazil.

We conducted this study in three conservation units of Distrito Federal: Parque Nacional de Brasilia (PNB) (15°41′42″ S, 048°08′10″ W), APA Gama-Cabeça-de-Veado (AGCV) (15°52′29″ S, 047°50′48″ W) and Estação Ecologíca Águas Emendadas (ESECAE) (15°36′32″ S, 047°33′03″ W) (Figure 1). The climate in the areas is classified as typical savannah, with two well-defined seasons, a rainy season (October to April) and a dry season (May to September). Ectoparasitic bat flies were collected from bats captured from April 2012 to August 2013. Bat flies were removed from the bats with forceps and placed in numbered Eppendorf® pots containing 70% ethanol. We identified the flies under a stereomicroscope (Motic K-series) using specialized identification keys (Guerrero 1993, 1994a, 1994b, 1995a, 1995b, 1996).

From the 1,733 specimens of bat flies that we have captured, 30 species of the family Streblidae belonging to three subfamilies and 11 genera, and eight species of the family Nycteribiidae belonging to the genus *Basilia* Miranda-Ribeiro, 1903. Twelve records are new for the Distrito Federal (Table 1).

Anastrebla caudiferae Wenzel, 1976 — Eight females from PNB, one female and four males from AGCV, and one female from ESECAE, all collected on *Anoura caudifer* specimens (Phyllostomidae). This species is known to occur in the states of Rio de Janeiro (Lourenço et al. 2014), Minas Gerais, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul (Graciolli et al. 2008), always in Atlantic Forest. This record is the first for the Brazilian Cerrado. Besides on the main host, *A. caudifer*, *A.*

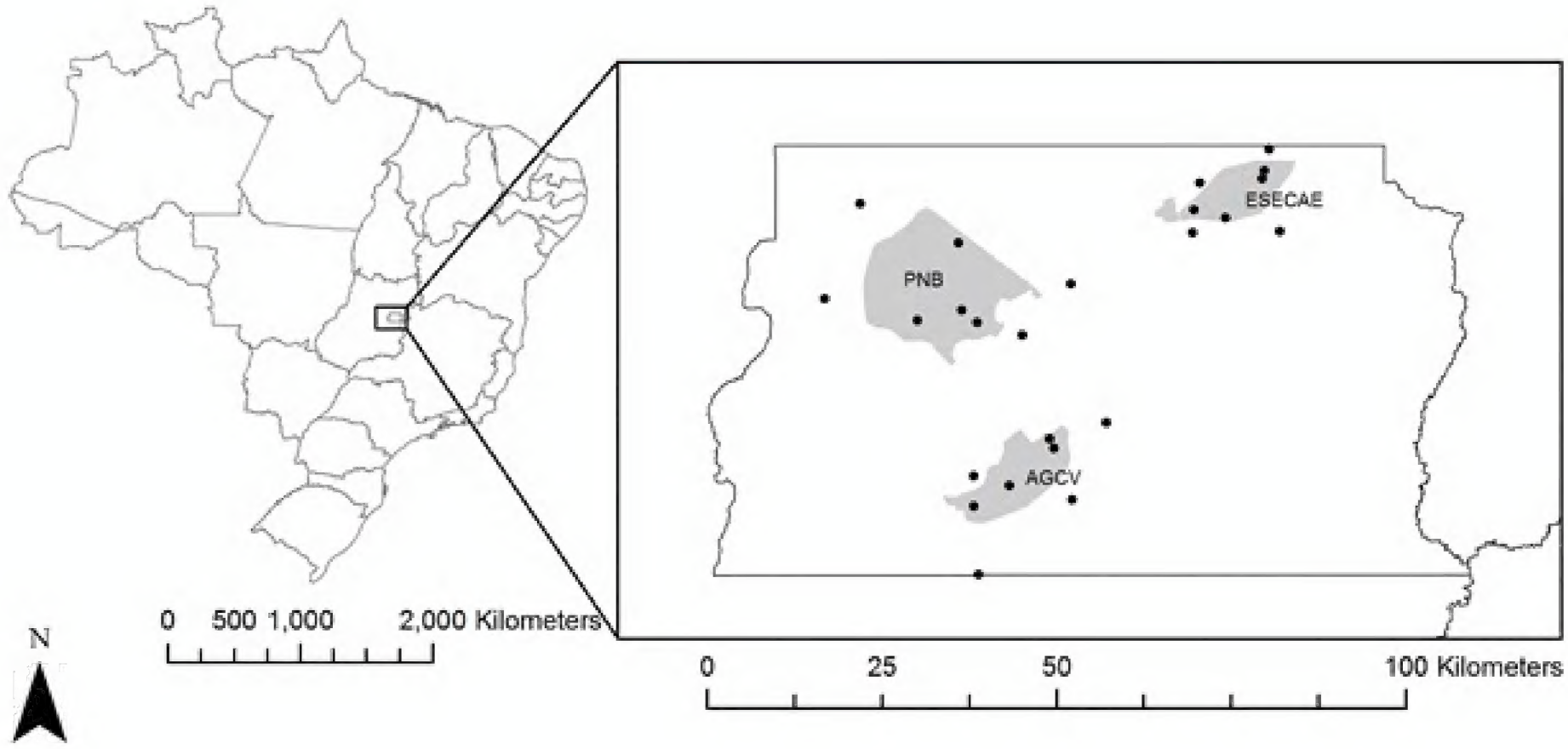

Figure 1. Study areas in Distrito Federal, Brazil. PNB, Parque Nacional de Brasília; AGCV, APA Gama-Cabeça-de-Veado; and ESECAE, Estação Ecologíca Águas Emendadas.

Table 1. New records of bat flies species, with their respective hosts, captured in different sites in Distrito Federal, Brazil, from April 2012 to August 2013.

Bat fly species	Host
STREBLIDAE	
Streblinae	
Anastrebla caudiferae[b]	Anoura caudifer
Strebla carvalhoi[b]	*Anoura caudifer, Sturnira lilium*[*]
Strebla curvata[c]	*Glossophaga soricina*
Strebla hertigi[c]	*Phyllostomus discolor*
Trichobiinae	
Trichobioides perspicillatus[c]	*Artibeus lituratus*[*], *Phyllostomus discolor*
Trichobius angulatus[c]	*Artibeus lituratus, Platyrrhinus lineatus*
Trichobius costalimai[c]	*Artibeus lituratus, Platyrrhinus lineatus*
Trichobius johnsonae[a]	*Glossophaga soricina*[*], *Pteronotus parnelii*
Trichobius tiptoni[c]	*Anoura caudifer, Artibeus planirostris*[*], *Carollia perspicillata*[*], *Micronycteris microtis*[*]
NYCTERIBIIDAE	
Nycteribiinae	
Basilia lindolphoi[b]	*Myotis nigricans*
Basilia mimoni[c]	*Mimon crenulatum*
Basilia new sp.[c]	*Myotis nigricans*

[*]accidental record; [a]new record for Brazil; [b]new record for the Cerrado; [c]new record for the Distrito Federal.

caudiferae was collected on the phyllostomid bats *Anoura geoffroyi*, *Artibeus lituratus*, and *Glossophaga soricina* (Phyllostomidae) (Graciolli et al. 2008), probably due to accidental records.

Strebla carvalhoi Graciolli, 2003 — one female and one male from PNB, and one female from ESECAE on *A. caudifer*; one female on *Sturnira lilium* (Phyllostomidae) from ESECAE. We extend the known distribution of this species northwards by 998 km to the Mid-west Region of Brazil. Previously, this species was known only from the Atlantic Forest of the states of São Paulo, Paraná, and Santa Catarina (Graciolli 2003), and this is the first record in the Cerrado.

Strebla curvata Wenzel, 1976 — one female from PNB and two females from ESECAE, on *G. soricina* (Phyllostomidae). It is a common species, with records known from the Cerrado of Goiás (Graciolli et al. 2010) and Mato Grosso do Sul (Eriksson et al. 2011). It is found on the primary host, *G. soricina* (Guerrero 1996).

Strebla hertigi Wenzel, 1966 — four females on *Phyllostomus discolor* (Phyllostomidae) from ESECAE. This bat fly species has a broad distribution, is known from Bolivia, Colombia, Costa Rica, El Salvador, Guatemala, Guyana, Mexico, Nicaragua, Peru, Suriname, Trinidad, and Venezuela, and is associated mainly with *P. hastatus* (Guerrero 1996). Our record represents the southernmost one in Brazil, as this species was previously known only from the states of Pará (from an unknown host species; Graciolli et al. 2008), Rio de Janeiro (found on *Tonatia bidens*; Almeida et al. 2011), and Maranhão (also on *P. discolor*; Dias et al. 2009; Santos et al. 2013).

Trichobioides perspicillatus (Pessôa & Galvão, 1937) — one female on *Artibeus lituratus* (Phyllostomidae), from AGCV, and one male on *P. discolor* from ESECAE. This species has been recorded from the states of Bahia (Graciolli et al. 2008), Goiás (Eriksson et al. 2011), Pernambuco (Soares et al. 2013), and Maranhão (Dias et al. 2009; Santos et al. 2013). Although the type-host of *T. perspicillatus* is *Carollia perspicillata* its primary host is *P. discolor.*

Trichobius angulatus Wenzel, 1976 — recorded on *A. lituratus*, captured at the PNB (1 female, 1 male) and AGCV (1, 2); and on *P. lineatus* from PNB (4 females, 5 males), ESECAE (14, 3), and AGCV (2, 1). *Trichobius*

angulatus has been recorded from the state of Mato Grosso do Sul on *P. lineatus* (Eriksson et al. 2011). This is the first record for the Distrito Federal.

Trichobius costalimai Guimarães, 1938 — three females and one male from PNB, 10 females and six males from ESECAE on *P. lineatus*; and one female from ESECAE and five females from AGCV on *A. lituratus*. It has been recorded from the states of Pernambuco (type locality), Rondônia (Graciolli et al. 2008), Maranhão (Dias et al. 2009), and Goiás (Graciolli et al. 2010). The primary host of this species is *P. discolor* (Phyllostomidae), the records on others bats are probably accidental (Guerrero 1994a).

Trichobius johnsonae Wenzel, 1966 — 24 females and 17 males from PNB, and two females and three males from ESECAE, on *Pteronotus parnellii* (Mormoopidae); one male on *G. soricina* from PNB. This species belongs to the *caecus* group, recorded previously in Colombia, Panama, Venezuela (Guerrero 1994a), Mexico (Guerrero and Morales-Malacara 1996), and Belize (Bärtschi 2000). This is the first record of this species in Brazil (Figure 2). Its host-type is *Pteronotus gymnonotus*, but it has been reported on other *Pteronotus* species (Guerrero 1994a); this suggests that our record is not accidental. We collected *T. johnsonae* on *P. parnellii* in PNB and ESECAE. In PNB we also observed the occurrence of *T. johnsonae* on *G. soricina*, but this may be an accidental record.

Trichobius tiptoni Wenzel, 1976 — eight females and six males from PNB, two females and two males from ESECAE, and one female and seven males from AGCV, on *A. caudifer*; on *A. planirostris* and *C. perspicillata* from PNB (two and one females, respectively); one female on *M. microtis* from ESECAE. In Brazil, this species is known from the states of Goiás (Eriksson et al. 2011), Rio de Janeiro (Almeida et al. 2011; França et al. 2013; Lourenço et al. 2014), Minas Gerais, São Paulo, Paraná, and Rio Grande do Sul and is mainly associated with *A. caudifer* (Graciolli et al. 2008). We have two probable accidental records on *M. microtis* and *C. perspicillata* (although this later association was also found in São Paulo; Graciolli et al. 2008).

Basilia lindolphoi Graciolli, 2001 — one female on *Myotis nigricans* (Vespertilionidae) from AGCV. *Basilia lindophoi* is known to be parasitic on *Myotis riparius* from São Paulo, on *M. nigricans* and *Myotis izecksohni* from Paraná, *M. nigricans* and *Myotis* sp. from Santa Catarina (Graciolli et al. 2008; Moratelli et al. 2011). There is also one accidental record on *Mimon bennettii* (Phyllosyomidae) (Graciolli et al. 2008). This is the first record of the species from the Brazilian Cerrado.

Basilia mimoni Theodor & Peterson, 1964 — two females on *Mimon crenulatum* (Phyllostomidae) from ESECAE. *Basilia mimoni* is known from Peru (Graciolli 2001) and recorded in Brazil from the states of Pará and Maranhão. All records are on *M. crenulatum* (Graciolli et al. 2008; Dias et al. 2009).

***Basilia* new sp.** — three males and four females on *M. nigricans* from PNB. This is an undescribed species, but it is known from the Cerrado of Goiás state where it was found parasitizing a *Myotis* sp. The species morphology is very similar to *B. quadrosae* Graciolli & Moura, 2004 and *B. ortizi* Machado-Allison, 1964 (Graciolli et al. 2010).

We present here the first record of *Trichobius johnsonae* to Brazil (Figure 2). We also record for the first time in the Cerrado three species: *Anastrebla caudiferae*, *Basilia lindolphoi,* and *Strebla carvalhoi.* In addition, we present the first record of eight other species in Distrito Federal, including an undescribed species of *Basilia*, increasing to 56 the number of known species to the state. The addition of 12 new species to the Distrito Federal highlights the need for more studies with bats and their ectoparasites in Brazil, because there are many areas with little or no study (Graciolli et al. 2010). Furthermore, with the increase in emergent diseases brought by bats and their ectoparasites, bat flies are the focus of international interest (Morse et al. 2012; Brook et al. 2015), which demonstrates the importance of studies with this group.

Figure 2. *Trichobius johsonae* collected from *Pteronotus parnelii* in Cerrado of Central Brazil, in dorsal and lateral views.

ACKNOWLEDGEMENTS

We thank FUNBIO and MMA, which funded the project "Bat pollinators in Protected Areas" and enable us to study the ectoparasites. GG is also grateful to the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), for the support provided (process # 302328/2012-2).

LITERATURE CITED

Aguiar, L.M.S. and Y. Antonini. 2011. Descriptive ecology of bat flies (Diptera: Hippoboscoidea) associated with vampire bats (Chiroptera: Phyllostomidae) in the cerrado of central Brazil. Memórias do Instituto Oswaldo Cruz 106(2): 170–176. doi: 10.1590/S0074-02762011000200009

Aguiar, L.M.S., W.R. Camargo and A.S. Portella.2006. Occurrence of white-winged vampire bat, *Diaemus youngi* (Mammalia, Chiroptera), in the cerrado of Distrito Federal, Brazil. Revista Brasileira de Zoologia 23: 893–896. doi: 10.1590/S0101-81752006000300041

Almeida, J.C., S.S.P. Silva, N.M. Serra-Freire, M.P. Valim. 2011. Ectoparasites (Insecta and Acari) associated with bats in Southeastern Brazil. Journal of Medical Entomology 48(4): 753–757. doi: 10.1603/ME09133

Bärtschi D 2000. A study of the Chiroptera of Shipstern Nature Reserve and north-eastern Belize (Central America) together with their ectoparasites (Streblidae, Nycterophiliinae, Acarina) and endoparasites (Cestoda, Nematoda, Trematoda, Acanthocephala). An occasional publication of the International Tropical Conservation Foundation. 16 pp.

Brook, C.E., Y. Bai, A.P. Dobson, L.M. Osikowicz, H.C. Ranaivoson, Q. Zhu and M.Y. Kosoy. 2015. *Bartonella* spp. in Fruit Bats and Blood-Feeding Ectoparasites in Madagascar. PLoS Neglected Tropical Diseases 9(2): e0003532. doi: 10.1371/journal.pntd.0003532

Coimba, Jr., C.E.A., L.R. Guimarães and D.A. Mello. 1984. Ocorrência de Streblidae (Diptera: Pupipara) em morcegos capturados em regiões do Cerrado do Brasil Central. Revista Brasileira de Entomologia 28(4): 547–550. http://157.86.8.70:8080/certifica/handle/icict/18980

Dias, P.A., C.L.C. dos Santos, F.S. Rodrigues, L.C. Rosa, K.S. Lobato and J.M.M. Rebêlo. 2009. Espécies de moscas ectoparasitas (Diptera, Hippoboscoidea) de morcegos (Mammalia, Chiroptera) no estado do Maranhão. Revista Brasileira de Entomologia 53(1): 128–133. doi: 10.1590/S0085-56262009000100027

Eriksson, A., G. Graciolli and E. Fischer. 2011. Bat flies on phyllostomid hosts in the Cerrado region: component community, prevalence and intensity of parasitism. Memórias do Instituto Oswaldo Cruz 106(3): 274–278. doi: 10.1590/S0074-02762011000300004

França, D.S., S.N. Pereira, A.C.S. Maas, M.A. Martins, D.P. Bolzan, I.P. Lima, D. Dias, A.L. Peracchi. 2013. Ectoparasitic flies (Diptera, Streblidae) of bats (Chiroptera, Phyllostomidae) in an Atlantic Forest area, southeastern Brazil. Brazilian Journal of Biology 73(4): 847–854. doi: 10.1590/S1519-69842013000400022

Graciolli, G. 2001. Distribuição geográfica e hospedeiros quirópteros (Mammalia, Chiroptera) de moscas nicteribidas americanas (Diptera, Nycteribiidae). Revista Brasileira de Zoologia 18(1): 307–322. doi: 10.1590/S0101-81752001000500026

Graciolli, G. 2003. Uma nova espécie de *Strebla* Wiedemann, 1824 (Diptera, Streblidae, Streblinae) sobre *Anoura caudifer* (E. Geoffroy, 1818) (Chiroptera, Phyllostomidae, Glossophaginae). Revista Brasileira de Entomologia 47(3): 435–436. doi: 10.1590/S0085-56262003000300012

Graciolli, G. and L.M.S. Aguiar. 2002. Ocorrência de moscas ectoparasitas (Diptera, Streblidae e Nycteribiidae) de morcegos (Mammalia, Chiroptera) no cerrado de Brasília, Distrito Federal, Brasil. Revista Brasileira de Zoologia 19 (1): 177–181. doi: 10.1590/S0101-81752002000500012

Graciolli, G. and D.C. Coelho. 2001. Streblidae (Diptera: Hippoboscoidea) sobre morcegos filostomídeos (Chiroptera: Phyllostomidae) em cavernas do Distrito Federal, Brasil. Revista Brasileira de Zoologia 18: 965–970. doi: 10.1590/S0101-81752001000300028

Graciolli, G., N.C. Cáceres and M.R. Bornschein. 2006. Novos registros de moscas ectoparasitas (Diptera, Streblidae e Nycteribiidae) de morcegos (Mammalia, Chiroptera) em áreas de transição cerrado-floresta estacional no Mato Grosso do Sul, Brasil. Biota Neotropica 6(2): 1-4. doi: 10.1590/S1676-06032006000200028

Graciolli, G., A.G. Autino and G.L. Claps. 2007. Catalogue of American Nycteribiidae (Diptera, Hippoboscoidea). Revista Brasileira de Entomologia 51(2): 142–159. doi: 10.1590/S0085-56262007000200004

Graciolli, G., A.A. Azevedo, M Árzua, D.M. Barros-Battesti and P.M. Linardi. 2008. Artrópodos ectoparasitos de morcegos no Brasil; pp. 123–138, in: S. Pacheco, R.V. Marques and C.E.L. Esbérard (eds.). Morcegos no Brasil: biologia, sistemática, ecologia e conservação, 1st edition. Porto Alegre: Armazém Digital.

Graciolli, G., M. Zortéa and L.F.A.C. Carvalho. 2010. Bat flies (Diptera, Streblidae and Nycteribiidae) in a Cerrado area of Goiás State, Brazil. Revista Brasileira de Entomologia 54(3): 511–514. doi: 10.1590/S0085-56262010000300025

Guerrero, R. 1993. Catalogo de los Streblidae (Diptera: Pupipara) parasitos de murciélagos (Mammalia: Chiroptera) del Nuevo Mundo. I. Clave para los géneros y Nycterophillinae. Acta Biologica Venezuelica 14: 61–75.

Guerrero, R. 1994a. Catalogo de los Streblidae (Diptera: Pupipara) parasitos de murciélagos (Mammalia: Chiroptera) del Nuevo Mundo. II. Los grupos: *pallidus, caecus, major, uniformis* y *longipes* del género *Trichobius* Gervais, 1844. Acta Biologica Venezuelica 15: 1–18.

Guerrero, R. 1994b. Catalogo de los Streblidae (Diptera: Pupipara) parasitos de murciélagos (Mammalia: Chiroptera) del Nuevo Mundo. IV. Trichobiinae com alas desarrolladas. Boletín de Entomologia Venezolana 9: 161–192.

Guerrero, R. 1995a. Catalogo de los Streblidae (Diptera: Pupipara) parasitos de murciélagos (Mammalia: Chiroptera) del Nuevo Mundo. III. Los gupos: *dugesii*, *dunni* y *phyllostomae* del género *Trichobius* Gervais, 1844. Acta Biologica Venezuelica 15: 1–27.

Guerrero, R. 1995b. Catalogo de los Streblidae (Diptera: Pupipara) pa-rasitos de murciélagos (Mammalia: Chiroptera) del Nuevo Mundo. V. Trichobiinae con alas reducidas o ausentes y miscelaneos. Boletín de Entomologia Venezolana 10: 135–160.

Guerrero, R. 1996. Catalogo de los Streblidae (Diptera: Pupipara) parasitos de murciélagos (Mammalia: Chiroptera) del Nuevo Mundo. VI. Streblinae. Acta Biologica Venezuelica 16: 1–25.

Guerrero, G. and J.B. Morales-Malacara. 1996. Streblidae (Diptera: Calyptratae) parásitos de murciélagos (Mammalia: Chiroptera) cavernícolas del centro y sur de México, con descripción de una especie nueva del género *Trichobius*. Anales del Instituto de Biología de la Universidad Autónoma del México, Serie Zoología 67(2): 357–373.

Lourenço, E.C., P.M.P. Patrício, M.C. Pinheiro, R.M. Dias, K.M. Famadas. 2014. Streblidae (Diptera) on bats (Chiroptera) in an area of Atlantic Forest, state of Rio de Janeiro. Revista Brasileira de Parasitologia Veterinária 23(2): 1–7. doi: 10.1590/S1984-29612014029

Marshall, A.G. 1982. Ecology of insects ectoparasitic on bats; pp. 369–401, in: J.H. Kunz (ed.) Ecology of bats. London: Plenum Publishing.

Moratelli, R., A.L. Peracchi, D. Dias and J.A. de Oliveira. 2011. Geographic variation in South American populations of *Myotis nigricans* (Schinz, 1821) (Chiroptera, Vespertilionidae), with the description of two new species. Mammalian Biology 76: 592–607. doi: 10.1016/j.mambio.2011.01.003

Morse, S.F., K.J. Olival, M. Kosoy, S.A. Billeter, B.D. Patterson, C.W. Dick and K. Dittmar. 2012. Global distribution and genetic diversity of *Bartonella* in bat flies (Hippoboscoidea, Streblidae, Nycteribiidae). Infection, Genetics and Evolution 12: 1717–1723. doi: 10.1016/j.meegid.2012.06.009

Peterson, B.V. and R.L. Wenzel. 1987. Nycteribiidae; pp. 1283–1301, in: J.F. McAlpine, B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth and D.M. Wood (eds.). Manual of Neartic Diptera, Vol. 2. Ottawa: Minister of Supply and Services, Monograph 28.

Santos C.L.C., A.C.N. Pereira, V.J.C. Bastos, G. Graciolli and J.M.M. Rebêlo. 2013. Parasitism of ectoparasitic flies on bats in the northern Brazilian cerrado. Acta Parasitologica 58(2): 207–214. doi: 10.2478/s11686-013-0135-9

Soares, F.A.M., G. Graciolli, D.M.C. Alcântara, C.E.B.P. Ribeiro, G.C. Valença and S.F. Ferrari. 2013. Bat flies (Diptera: Streblidae) ectoparasites of bats at an Atlantic Rainforest site in northeastern Brazil. Biota Neotropica 13(2): 242–246. doi: 10.1590/S1676-06032013000200024

Whitaker, Jr. J.O. 1988. Collecting and preserving ectoparasites for ecological study; pp. 459–474, in: J.H. Kunz (ed.). Ecological and behavioral methods for the study of bats. Washington: Smithsonian Institution Press.

Authors' contribution statement:
DF collected the data and identified species; GG confirmed all identifications; DF, GG, and LMSA wrote the text.

Received: 20 May 2015
Accepted: 4 August 2015
Academic editor: Jonas da Silva Döge